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(54) Variable valve lift mechanism for engine and arrangement of oil control valve

(57) An engine (3) has a cylinder block (32) mounted on a crankcase (31) and a cylinder head (33) mounted on the cylinder block (32). The cylinder head (33) has one side forming an intake port (331) and an intake valve (332) and another side forming an exhaust port (333) and an exhaust valve (334). A camshaft (336) includes an intake cam assembly (3361) and an the exhaust cam assembly (3362), which respectively drive an intake valve driving member (337) and an exhaust valve driving member (337'). The intake cam assembly (3361) includes a first intake cam (3361a) and a second intake cam (3361b). The intake valve driving member (337) includes a low lift driving member (3371) corresponding to the first intake cam (3361a) and a high lift driving member (3372) corresponding to the second intake cam (3361b). The low lift driving member (3371) and the high lift driving member (3372) form a hydraulic cylinder (338), which receives therein hydraulically operable pistons (3381, 3382).

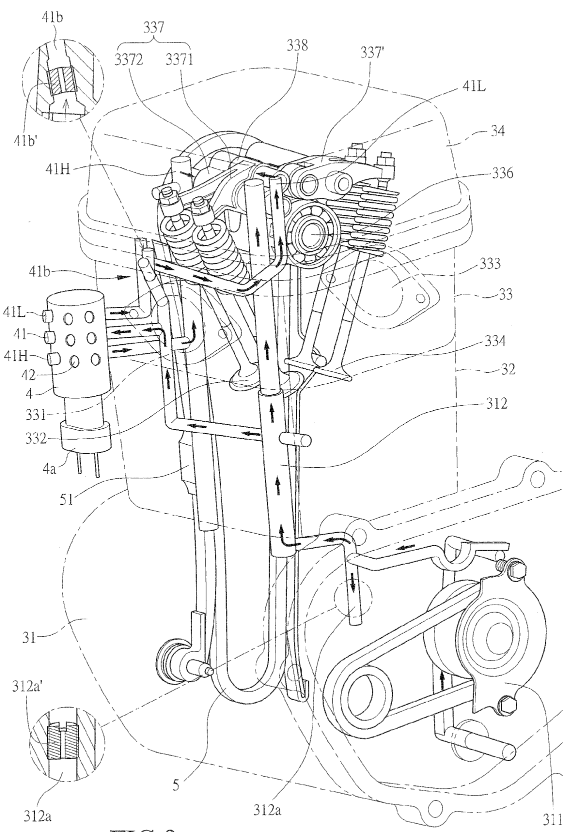

FIG.3

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Description

(a) Technical Field of the Invention

[0001] The present invention generally relates to a variable valve lift mechanism for engine and an arrangement of oil control valve, and more particularly to a structure that prevent interference of the oil control valve with maintenance of other parts and realizes movement of valve driving member of engine for high and low lifts in order to miniaturize the oil pump and reduce engine power loss.

(b) Description of the Prior Art

[0002] Oil passage arrangement for a conventional variable valve lift mechanism of an engine 1 is shown in FIG 1, wherein an electromagnet valve 2 is mounted on a cylinder head 11. Oil received at hydraulic oil entrance is guided by a pipe 21 to supply external pressure to the electromagnetic valve 2, and then the electromagnetic valve 2 introduces the lubrication oil into oil passages inside the cylinder head 11 to allow the hydraulic pressure to be applied to drive variable lift mechanism of each cylinder so as to realize switching of intake and exhaust valves in response to different rotational speeds of the engine 1.

[0003] The arrangement of the electromagnetic valve 2 and the oil pipe 21 of the conventional engine 1 are effective in realizing switching of intake and exhaust valves in response to different rotational speeds of the engine 1. However, the electromagnetic valve 2 is mounted to the cylinder head 11 by bolts 22. The assembling is complicated. Further, the oil pipe 21 connected to the electromagnetic valve 2 is susceptible to oil leakage and due to exposure outside the engine 1, it is susceptible to damage due to high temperature of the engine 1. Further, since the electromagnetic valve 2 is arranged above the cylinder head 11, when the engine 1 swings, the electromagnetic valve 2 may easily get interfering with an upper side part, such as a storage box.

[0004] In view of the above discussed problems of the conventional arrangement of oil passage for variable valve lift mechanism, the present invention aims to provide an oil control valve that simplifies the assembling of engine and allows of easy arrangement of lubrication oil passage and a structure to miniaturize the oil pump and reduce power loss of engine.

SUMMARY OF THE INVENTION

[0005] The technical solution adopted in the present invention is to provide a variable valve lift mechanism and arrangement of control valve. The engine comprises a cylinder block mounted on a crankcase and a cylinder head mounted on the cylinder block. The cylinder head has one side forming an intake port and an intake valve and another side forming an exhaust port and an exhaust valve. A throttle valve communicates through an intake tube with the intake port. The intake valve and the exhaust valve are provided therebetween with a camshaft base. The camshaft base comprises a camshaft, and the camshaft comprises an intake cam assembly and an exhaust cam assembly, which respectively drive an intake valve driving member and an exhaust valve driving member. The intake cam assembly includes a first intake cam and a second intake cam. The intake valve driving member comprises a low lift driving member corresponding to the first intake cam and a high lift driving member corresponding to the second intake cam. The low lift driving member and the high lift driving member form a hydraulic cylinder, which receives therein hydraulically operable pistons. The oil control valve comprises a driving oil passage communicating the hydraulic cylinder. The high lift driving member of the intake valve driving member is closer to the oil control valve than the low lift driving member. The path of the driving oil passage of the oil control valve and the high lift driving member is shorter than the path of the driving oil passage that the oil control valve drives the low lift driving member.

[0006] Another technical solution adopted in the present invention is to provide a variable valve lift mechanism for engine and arrangement of oil control valve, wherein the oil control valve seat is integrally formed on a surface of an intake port side of the cylinder head to be substantially perpendicular to an intake port and is located on an outer wall of a timing chain chamber. The oil control valve seat is set lower than the greatest height of the throttle valve. Further, the oil control valve seat is substantially in line with a timing chain tensioner and is located on the same side as the timing chain and is substantially parallel to the intake tube. The oil control valve seat forms an opening that is faces toward the cylinder block to receive the oil control valve to be mounted thereto. The oil control valve is mounted to the oil control valve seat in such a way to face from the cylinder block toward the cylinder head. In other words, a wire outlet joint end of the oil control valve faces toward the cylinder block in order to eliminate interference of the oil control valve with maintenance of other parts.

[0007] The foregoing objectives and summary provide only a brief introduction to the present invention. To fully appreciate these and other objects of the present invention as well as the invention itself, all of which will become apparent to those skilled in the art, the following detailed description of the invention and the claims should be read in conjunction with the accompanying drawings. Throughout the specification and drawings identical reference numerals refer to identical or similar parts.

[0008] Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG 1 is a perspective view of a conventional cylinder head.
FIG 2 is a cross-sectional view of an engine according to the present invention.
FIG 3 is a perspective view schematically showing oil route according to the present invention.
FIG 4 is a perspective view of an engine according to the present invention.
FIG. 5 is a schematic view of a variable valve lift mechanism according to the present invention.
FIGS. 6 and 7 are schematic views illustrating the operation of the variable valve lift mechanism according to the present invention.
FIG. 8 is a perspective view illustrating an oil control valve according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] The following descriptions are exemplary embodiments only, and are not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention as set forth in the appended claims.

[0011] The present invention provides an engine 3, which is arranged, in a substantially horizontal manner, on a scooter as a rocker engine 3. First of all, reference is made to FIG. 2. The engine 3 according to the present invention comprises a crankcase 31, a cylinder block 32 mounted on the crankcase 31, a cylinder head 33 mounted on the cylinder block 32, and a cylinder head cover 34.

[0012] The crankcase 31 receives therein a crankshaft 310. Referring to FIG 3, the crankcase 31 comprises therein an oil pump 311. The oil pump 311 pumps oil into a primary oil supply passage 312. The primary oil supply passage 312 extends from the crankcase 31 through the cylinder block 32 to the oil control valve 4 mounted to the cylinder head 33. The primary oil supply passage 312 has an end forming a crankshaft oil supply passage 312a toward the crankcase 31. The crankshaft oil supply passage 312a has an end forming a throttle arrangement 312a' that supplies oil to a crankshaft bearing. The throttle arrangement 312a' comprises a nozzle. The throttle arrangement 312a' functions to regulate the internal pressure of the primary oil supply passage 312 and the ejected amount of oil and also functions to direct the oil to eject to a predetermined direction.

[0013] The cylinder block 32 is coupled to the crankcase 31 and allows a timing chain 5 to extend therethrough. The cylinder block 32 comprises a timing chain tensioner 51 arranged at the intake port 331 side of the cylinder head 33, as shown in FIGS. 1 and 4. Further, the timing chain tensioner 51 is arranged to be substantially in line with the oil control valve 4. Since the timing chain chamber 330 provides a large amount of internal space, it is possible to prevent heat accumulation occurring at the location where an oil control valve seat 339 is mounted.

[0014] The cylinder head 33 comprises an intake port 331 and an intake valve 332 arranged at the intake side and an exhaust port 333 and an exhaust valve 334 arranged at the exhaust side. A throttle valve 6 communicates through an intake tube 321 with the intake port 331 of the intake side. Referring to FIGS. 3, 4, 5, and 6, the cylinder head 33 comprises an integrally formed cast camshaft base 335 between the intake valve 332 and the exhaust valve 334. The camshaft base 335 supports a rotatable camshaft 336. The camshaft 336 comprises an intake cam assembly 3361 and an exhaust cam assembly 3362 mounted thereon. The intake cam assembly 3361 includes a first intake cam 3361a (which is a low lift cam) and a second intake cam 3361b (which is a high lift cam). The intake cam assembly 3361 and the exhaust cam assembly 3362 function to push intake valve driving member 337 and exhaust valve driving member 337' of the intake valve 332 and the exhaust valve 334 during the rotation of the camshaft 336. The intake valve driving member 337 comprises a low lift driving member 3371 and a high lift driving member 3372 of variable valve lift mechanism. The low lift driving member 3371 and the high lift driving member 3372 are provided with a hydraulic cylinder 338. The hydraulic cylinder 338 receives therein a first piston 3381 and a second piston that can be hydraulically moved. The oil control valve 4 comprises a driving oil passage 3383 communicating the hydraulic cylinder 338. The driving oil passage 3383 includes a first driving oil passageway 3383a and a second driving oil passageway, which are respectively located at the ends of the low lift driving member 3371 and the high lift driving member 3372 close to the hydraulic cylinder 338. The oil control valve 4 functions to set the low lift driving member 3371 and the high lift driving member 3372 to move together or to move individually. The driving oil passage 3383 extends from an oil control valve seat 339 outside the cylinder head 33 through the cylinder head 33 and the camshaft base 335 to the hydraulic cylinder 338 of the valve driving member 337. Referring to FIGS. 3 and 6, the oil control valve seat 339 is integrally formed on a surface of the intake port 331 of the cylinder head 33 to be substantially parallel to the intake tube 321 and is located on an outer wall of the timing chain chamber 330. The oil control valve seat 339 is set to be lower than the greatest height of the throttle valve 6. Further, the oil control valve seat 339 is substantially in line with the timing chain tensioner 51 and is located at the same side of the timing chain 5. The oil control valve seat 339 forms an opening 3391, and opening 3391 is arranged to face the cylinder block 32 to receive the oil control valve 4 to be mounted thereto. The oil control valve 4 is mounted on the oil control valve seat 339 in such a way to face from the cylinder block 32 toward the cylinder head 33. In other words, a wire outlet joint end 4a of the oil control valve 4 faces toward the cylinder block 32. Further, the high lift driving member 3372 of the intake valve driving member 337 is arranged close to the oil control valve 4. In other words, the high lift driving member 3372 of the intake valve driving member 337 is more close to the oil control valve 4 than the low lift driving member 3371. Namely, the path of the driving oil passage 41H of the oil control valve 4 and the high lift driving member 3372 is shorter than the driving oil passage 41L that the oil control valve 4 drives the low lift driving member 3371. The oil control valve 4 is arranged in a substantially horizontal on the cylinder head 33 in order to eliminate the influence caused by gravity and thereby reducing the consumption of electrical power.

[0015] The cylinder head cover 34 is arranged on the cylinder head 33.

[0016] To practice the present invention, as shown in FIG 3, the oil pump 311 arranged in the crankcase 31 pumps oil to the primary oil supply passage 312, which extends from the crankcase 31 through the cylinder block 32 to communicate the oil control valve 4 arranged in the cylinder head 33. The oil control valve 4 comprises a plurality of oil channels 41 inside the cylinder head 33, and the oil control valve 4 forms a plurality of oil apertures 42. The number of the oil apertures 42 of the oil control valve 4 determines the number of oil channels inside the cylinder head 33. Further, the end of the primary oil supply passage 312 toward the crankcase 31 forms a crankshaft oil supply passage 41a. Referring to FIGS. 3, 5, and 6, the primary oil supply passage 312 has an end toward the cylinder head cover 34 and the end forming a valve driving member oil supply passage 41b. The valve driving member oil supply passage 41b communicates the cylinder head 33. Through the communication of the valve driving member oil supply passage 4 1 b with the cylinder head 33, oil is allowed to freely supply to the intake valve driving member 337. The valve driving member oil supply passage 41b comprises a throttle arrangement 41 b' inside the cylinder head cover 34. The throttle arrangement 41b' comprises a nozzle. The throttle arrangement 41b' regulates the internal pressure of the primary oil supply passage 312 and the amount of oil ejected, and to eject the oil in a predetermined direction in order to realize lubrication of the valve driving member 337.

[0017] Referring to FIGS. 5 and 6, the oil control valve 4 supplies oil into the first driving oil passageway 3383a of the driving oil passage 3383 of the cylinder head 33 to enter the hydraulic cylinder 338. A control center ECU (not shown) of the engine 3 detects the moving condition of the vehicle and when it is determined that the valve needs to be opened in a low lift extent, the control center ECU of the engine 3 controls the oil control valve 4 to supply oil from the driving oil passage 3383 into the hydraulic cylinder 338, as shown in FIG 6, whereby hydraulic pressure causes the first piston 3381 and the second piston 3382 to move toward the high lift driving member 3372 to have the second piston 3382 located inside the high lift driving member 3372 and the first piston 3381 located inside the low lift driving member 3371. Under this condition, the low lift driving member 3371 and the high lift driving member 3372 are allowed to individually rotate. Under this condition, due to engagement between the low lift driving member 3371 and the first intake cam 3361a (namely the low lift cam) of the camshaft 336, the intake valve of the engine 3 is set in a low lift opening condition. As shown in FIG 7, when the engine 3 is caused by a change of the moving condition of the vehicle to have the intake vale changed to a high lift opening coition, the control center ECU of the engine 3 controls the oil control valve 4 to supply oil from the second driving oil passageway 3383b of the driving oil passage 3383 into the hydraulic cylinder 338. The hydraulic pressure causes the first piston 3381 and the second piston 3382 to move toward the low lift driving member 3371 to have the first piston 3381 located in the low lift driving member 3371 and the second piston 3382 located at a position between the low lift driving member 3371 and the high lift driving member 3372. Under this condition, the low lift driving member 3371 and the high lift driving member 3372 are movable in unison with each other. Due to the engagement between the high lift driving member 3372 and the second intake cam 3361b (namely the high lift cam) of the camshaft 3361, the low lift driving member 3371 is moved by the high lift driving member 3372 to set the intake valve 332 to a desired high lift opening condition by the lift of the second intake cam 3361b (namely the high lift cam). This realizes variation of valve lift of the engine 3.

[0018] Alternatively, in the practice of the oil control valve 4 according to the present invention, as shown in FIG 8, the oil control valve seat 339 forms an opening 3391, which faces toward the cylinder head 33 to receive the oil control valve 4 mounted thereto. The oil control valve 4 is mounted on the oil control valve seat 339 in such a way to face from the cylinder head 33 toward the cylinder block 32. In other words, a wire outlet joint end 4a of the oil control valve 4 faces toward the cylinder head 33. Similarly, the high lift driving member 3372 of the intake valve driving member 337 is arranged close to the oil control valve 4. In other words, the high lift driving member 3372 of the intake valve driving member 337 is more close to the oil control valve 4 than the low lift driving member 3371.

[0019] The effectiveness of the present invention is that an oil control valve seat 339 is mounted to a surface on the intake port 331 side of the cylinder head 33 and located on an outer wall of the timing chain chamber 330, the oil control valve seat 339 is mounted between the intake port 331 and not exceeding the greatest height of the throttle valve 6; the oil control valve 4 is mounted on the oil control valve seat 339 in such a way to face from the cylinder block 32 toward the cylinder head 33, namely a wire outlet joint end of the oil control valve 4 facing toward the cylinder block 32, whereby the oil control valve 4 is set away from high temperature of the engine 3 to prevent the oil control valve seat 339 from becoming a heat concentration object and to improve the durability of the oil control valve 4 and also to realize easy arrangement and eliminate interference of the oil control valve 4 with the maintenance of other parts. Further, the high lift driving member 3372 of the valve driving member 337 is arranged close to the oil control valve 4, namely, the high lift driving member 3372 of the valve driving member 337 being more close to the oil control valve 4 than the low lift driving member 3371, whereby the oil path that the oil control valve 4 supplies oil to the high lift driving member 3372 is shortened and the pressure loss is reduced thereby making the high lift driving member 3372 operating in a more reliable manner. Since the oil path that the oil control valve 4 supplies oil to the high lift driving member 3372 is shortened, the loss of oil pressure that the oil control valve 4 supplies to the high lift driving member 3372 is reduced, so that the oil pump 311 that supplies the oil can be miniaturized to thereby reduce the installation cost of the oil pump 311 and the consumption of power of the engine 3, and allows internal arrangement of the engine 3 compact.

[0020] It will be understood that each of the elements described above, or two or more together may also find a useful application in other types of methods differing from the type described above.

[0021] While certain novel features of this invention have been shown and described and are pointed out in the annexed claim, it is not intended to be limited to the details above, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing in any way from the spirit of the present invention.

Claims

1. A variable valve lift mechanism for engine and arrangement of oil control valve, the engine (3) comprising a cylinder block (32) mounted on a crankcase (31) and a cylinder head (33) mounted on the cylinder block (32), the cylinder head (33) forming, in one side, an intake port (331) and an intake valve (332) and an exhaust port (333) and an exhaust valve (334) on another side, a throttle valve (6) communicating through an intake tube (321) with the intake port (331), the intake valve (332) and the exhaust valve (334) being provided therebetween with a camshaft base (335), the camshaft base (335) rotatably supporting a camshaft (336), the camshaft (336) carrying therein an intake cam assembly (3361) and an exhaust cam assembly (3362), the intake cam assembly (3361) and the exhaust cam assembly (3362) respectively driving an intake valve driving member (337) and an exhaust valve driving member (337'), wherein the intake cam assembly (3361) comprises a first intake cam (3361a) and a second intake cam (3361b), the intake valve driving member (337) comprising a low lift driving member (3371) corresponding to the first intake cam (3361a) and a high lift driving member (3372) corresponding to the second intake cam (3361b), the low lift driving member (3371) and the high lift driving member (3372) forming therein a hydraulic cylinder (338), the hydraulic cylinder (338) receiving therein hydraulically operable pistons (3381, 3382), the oil control valve (4) comprising a driving oil passage (383) communicating the hydraulic cylinder (338), **characterized in that** the high lift driving member (3372) of the intake valve driving member (337) is more close to the oil control valve (4) than the low lift driving member (3371) and the driving oil passage (41H) of the oil control valve (4) and the high lift driving member (3372) is shorter than the driving oil passage (41L) that the oil control valve (4) drives the low lift driving member (3371).

2. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the surface of the cylinder head (33) on the intake side is provided with an oil control valve seat (339), which is located on an outer wall of a timing chain chamber (330), the oil control valve seat (339) being lower than a greatest height of the throttle valve (6), the oil control valve (4) being mounted to the oil control valve seat (339).

3. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 2, wherein the oil control valve seat (339) forms an opening (3391), which faces the cylinder block (32), whereby the oil control valve (4) is mounted to the oil control valve seat (339) in such a way to face from the cylinder block (32) toward the cylinder head (33), the oil control valve (4) having a wire outlet joint end (4a) facing the cylinder block (32).

4. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 2, wherein the oil control valve seat (339) forms an opening (3391), which faces toward the cylinder head (33), whereby the oil control valve (4) is mounted to the oil control valve seat (339) in such a way to face from the cylinder head (33) toward the cylinder block (32), the oil control valve (4) having a wire outlet joint end (4a) facing toward the cylinder head (33).

5. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1,

wherein the cylinder block (32) comprises a timing chain tensioner (51) arranged therein, the oil control valve seat (339) being arranged to be substantially in line with the timing chain tensioner (51).

6. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the oil control valve seat (339) and the camshaft base (335) are integrally formed with the cylinder head (33).

7. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 3, wherein the oil control valve (4) is mounted to the oil control valve seat (339) and is substantially parallel to a wall of the cylinder head (33).

8. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the driving oil passage (3383) comprises a first driving oil passageway (3383a) and a second driving oil passageway (3383b) corresponding to the hydraulic cylinder (38), the first driving oil passageway (3383a) being associated with the low lift driving member (3371), the second driving oil passageway (3383b) being associated with the high lift driving member (3372).

9. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the first intake cam (3361a) is a low lift valve intake cam, the second intake cam (3361b) being a high lift valve intake cam.

10. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the engine (3) is arranged substantially horizontally, the oil control valve seat (339) being substantially parallel to an intake tube (321), the oil control valve (4) being arranged on the cylinder head (33) of the engine (3) in a substantially horizontal manner.

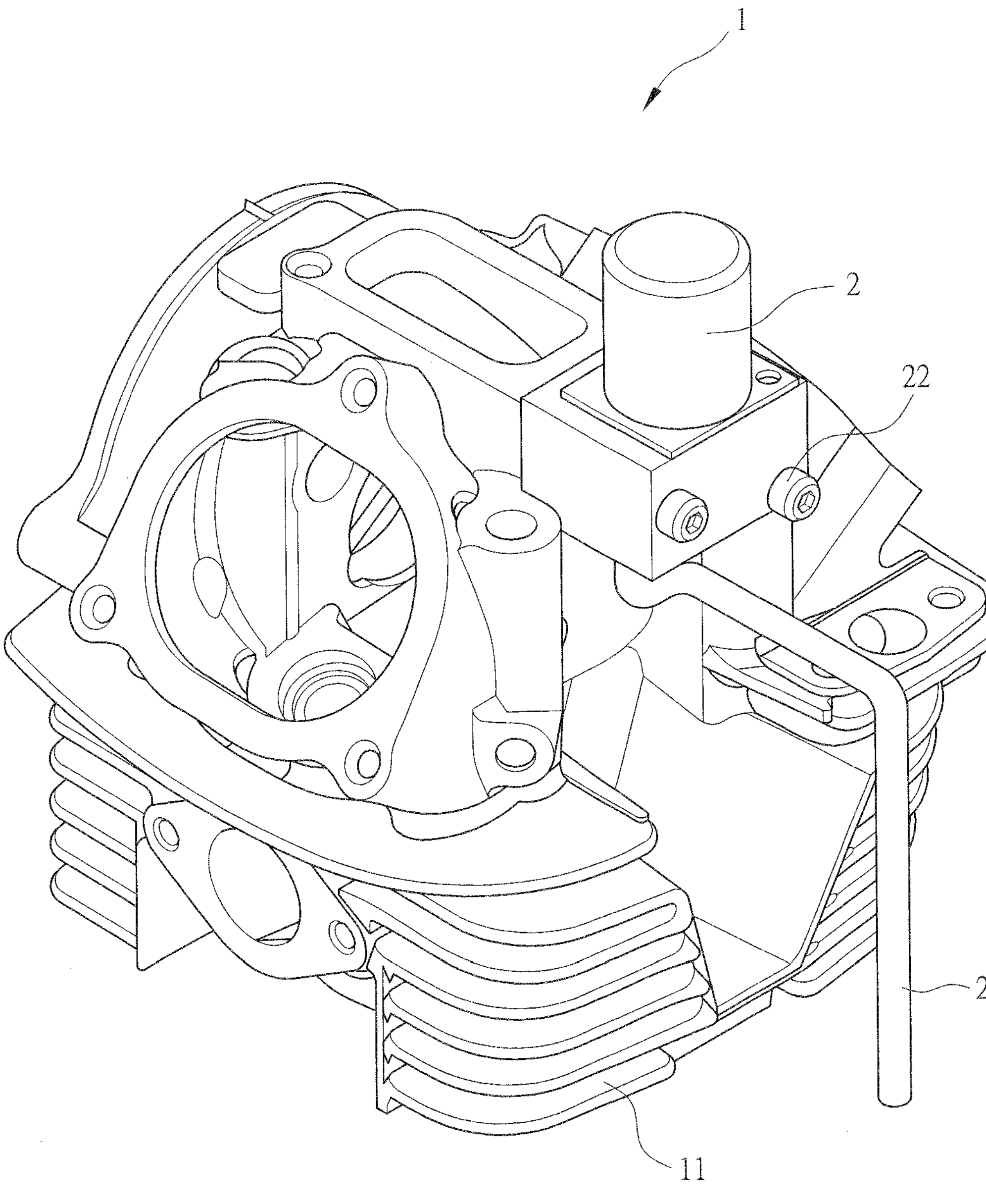
11. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the primary oil supply passage (312) has an end toward the crankcase (31), the end forming a crankshaft oil supply passage (312a).

12. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 11, wherein the crankshaft oil supply passage (312a) has an end provided with a throttle arrangement (312a').

13. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 1, wherein the primary oil supply passage (312) has an end toward a cylinder head cover (34), the end being provided with a valve driving member oil supply passage (41b).

14. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 13, wherein the valve driving member oil supply passage (41b) is provided with a throttle arrangement (41b').

15. The variable valve lift mechanism for engine and arrangement of oil control valve according to claim 12 or 14, wherein the throttle arrangement (312a', 41 b') comprises a nozzle.



PRIOR ART
FIG.1

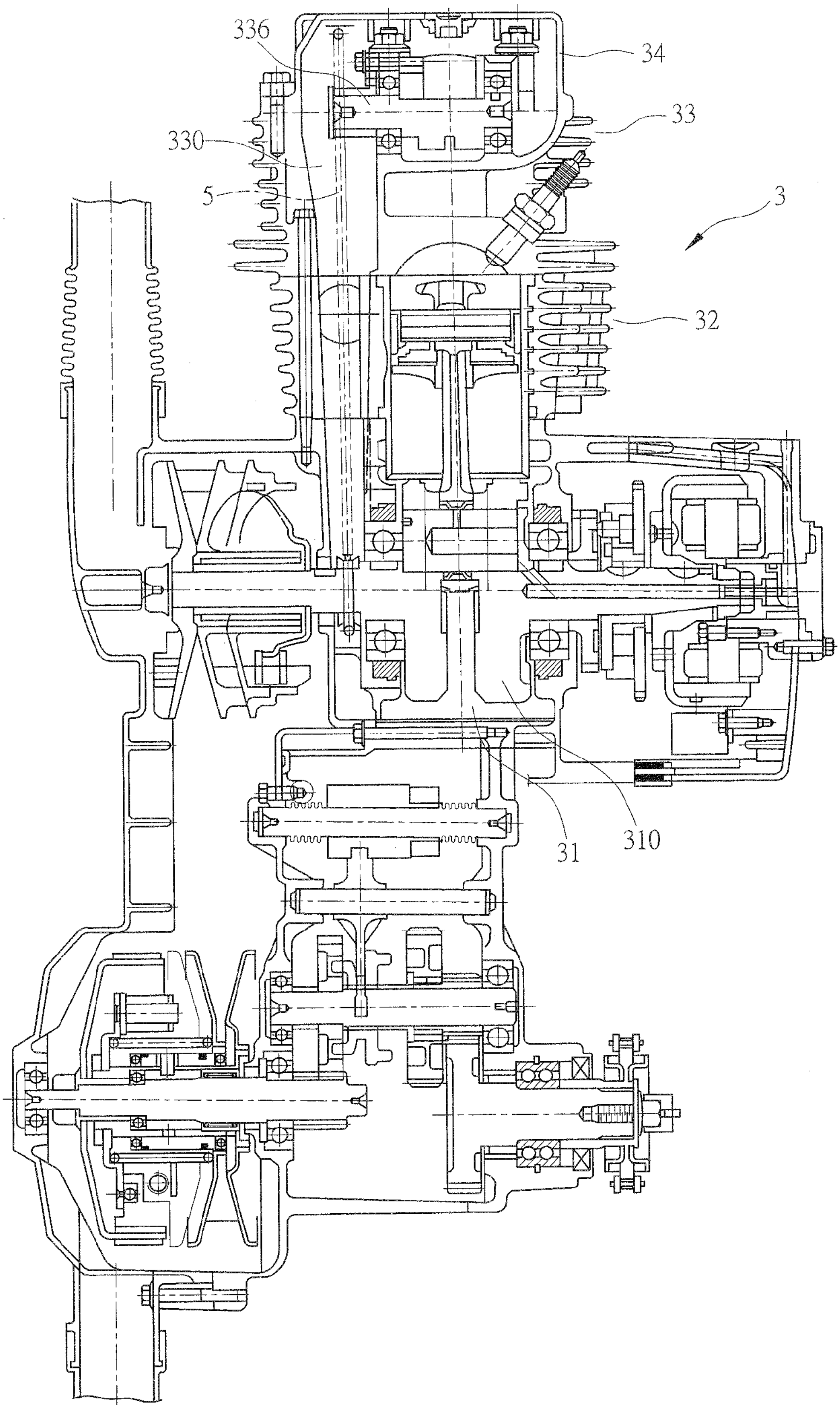
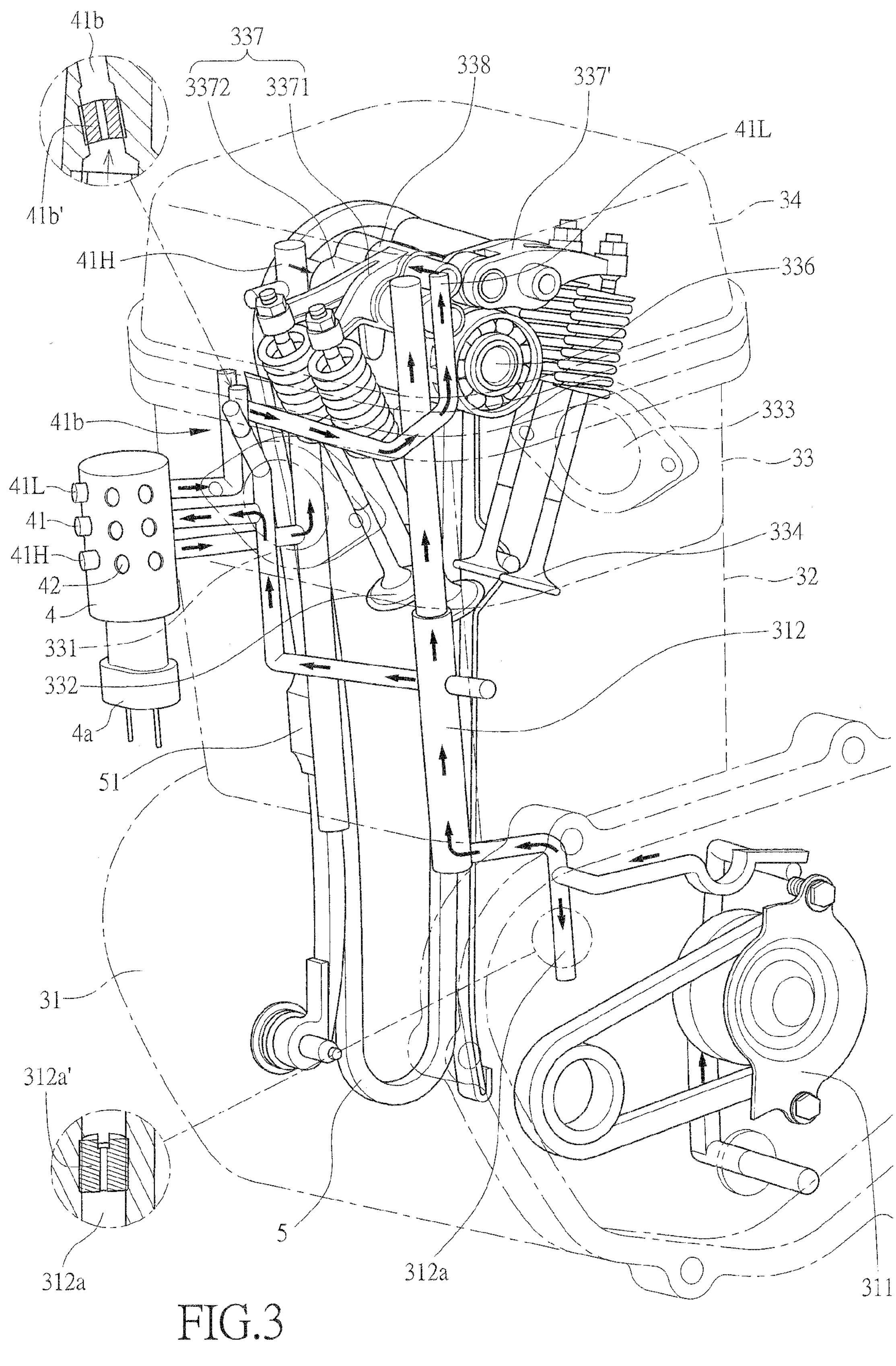


FIG.2


41b
337
3372
3371
338
337'
41L
34
41b'
41H
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333
41b
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41L
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41H
334
32
42
4
331
312
332
4a
51
31
312a'
5
312a
312a
311

FIG.3

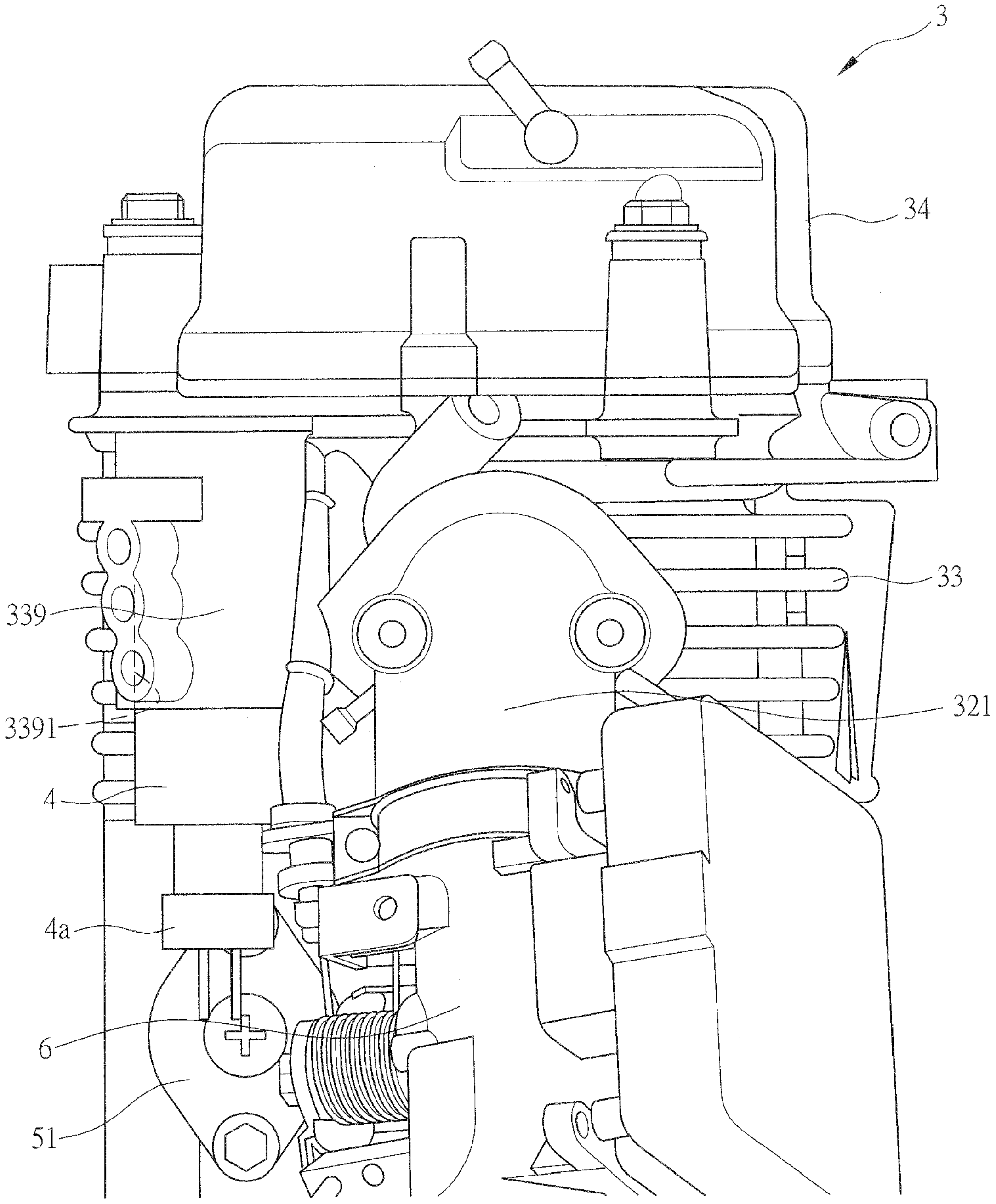


FIG.4

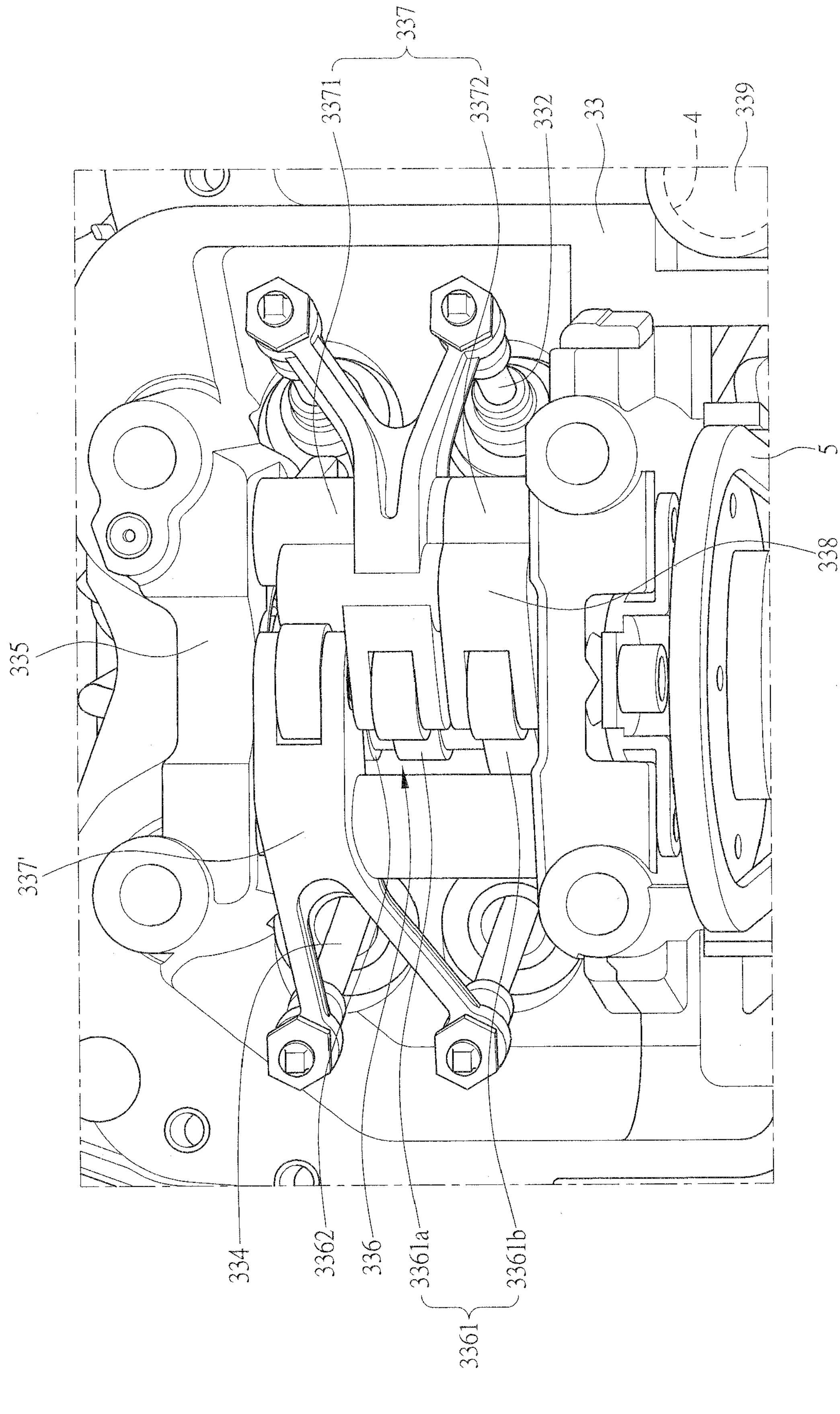
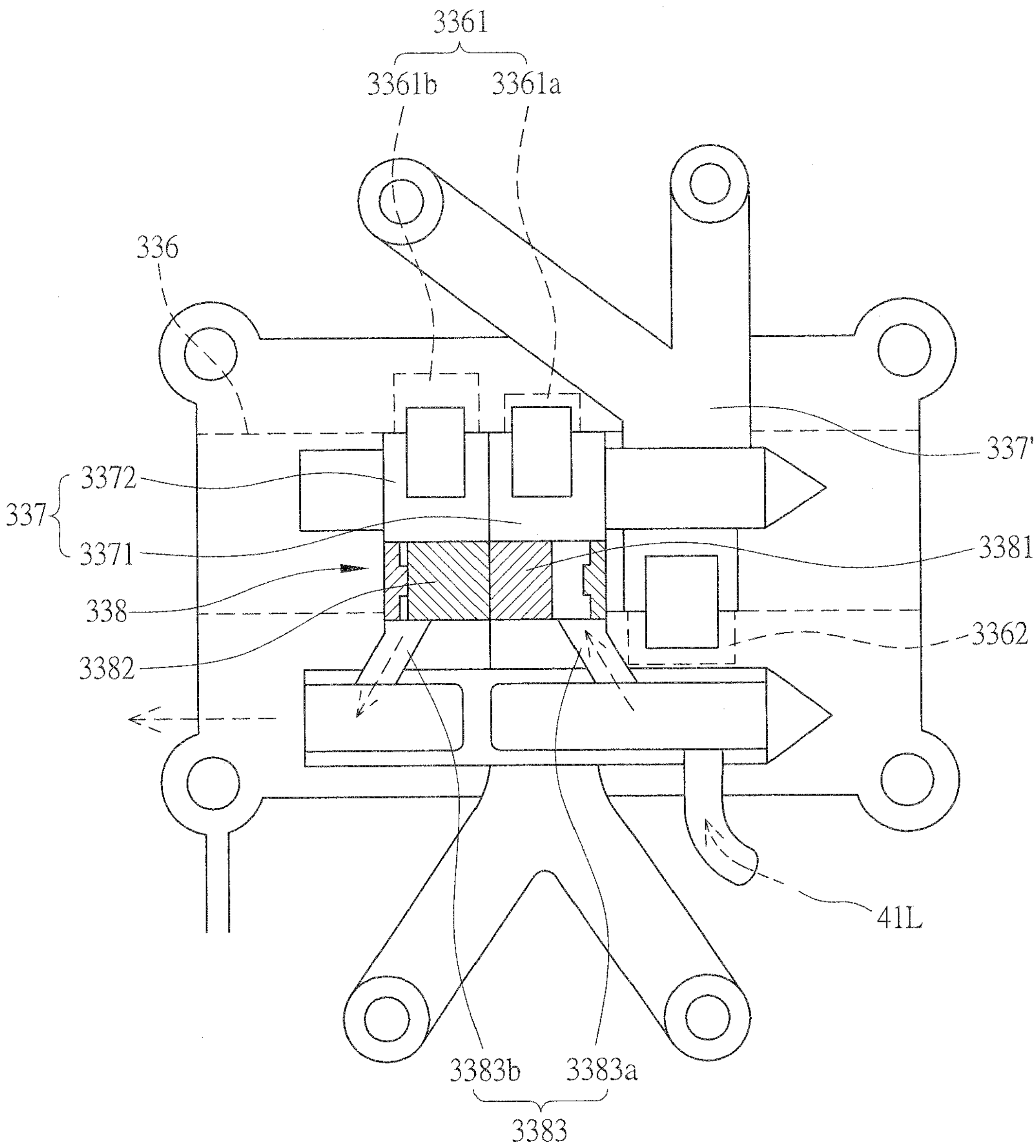

337
3371
3372
332
33
4
339
5
338
335
337'
334
3362
336
3361a
3361b
3361

FIG.5


3361
3361b
3361a
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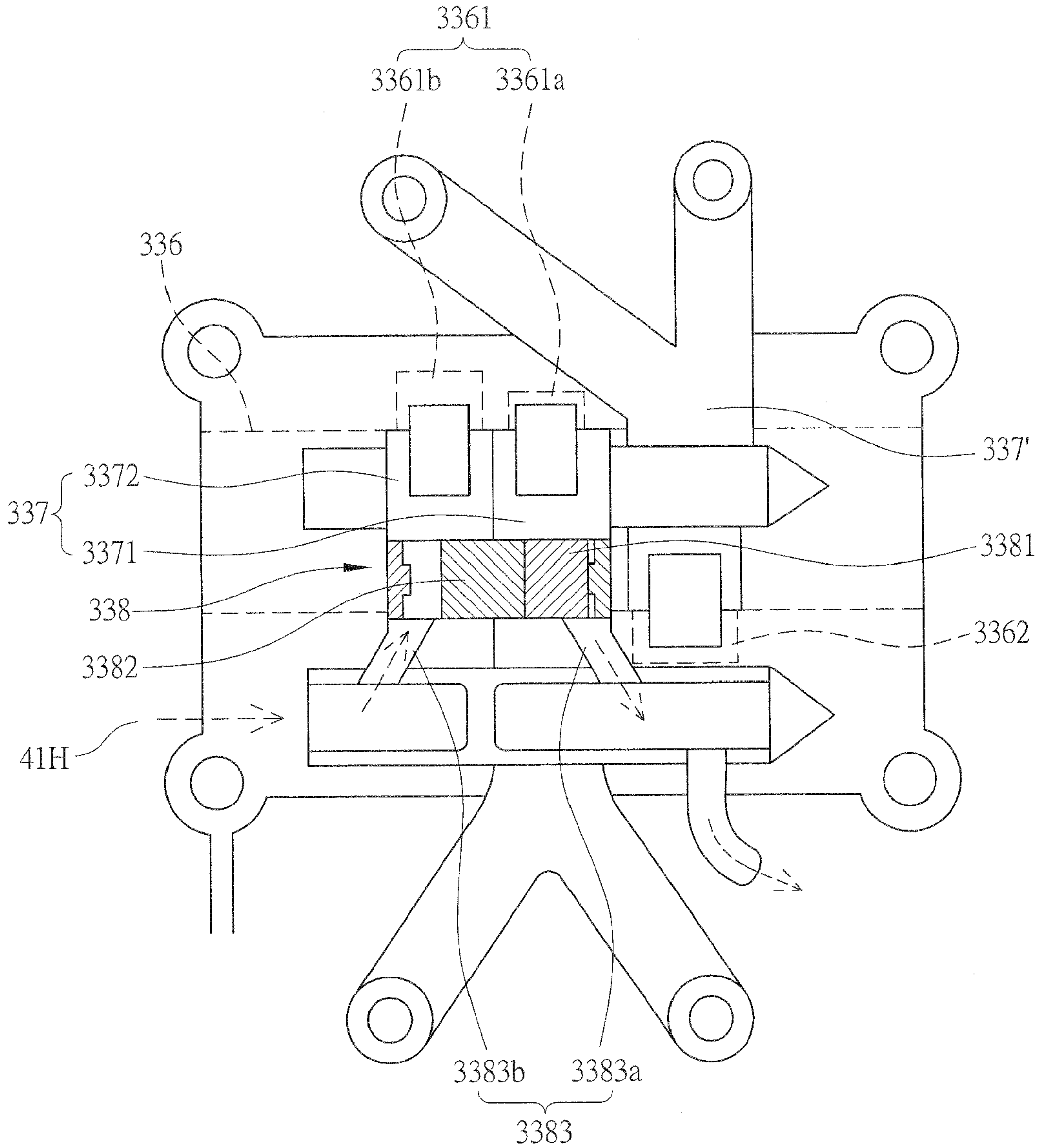
337'
3372
337
3371
3381
338
3362
3382
41L
3383b
3383a
3383

FIG.6


3361
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3381
338
3362
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41H
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3383a
3383

FIG.7

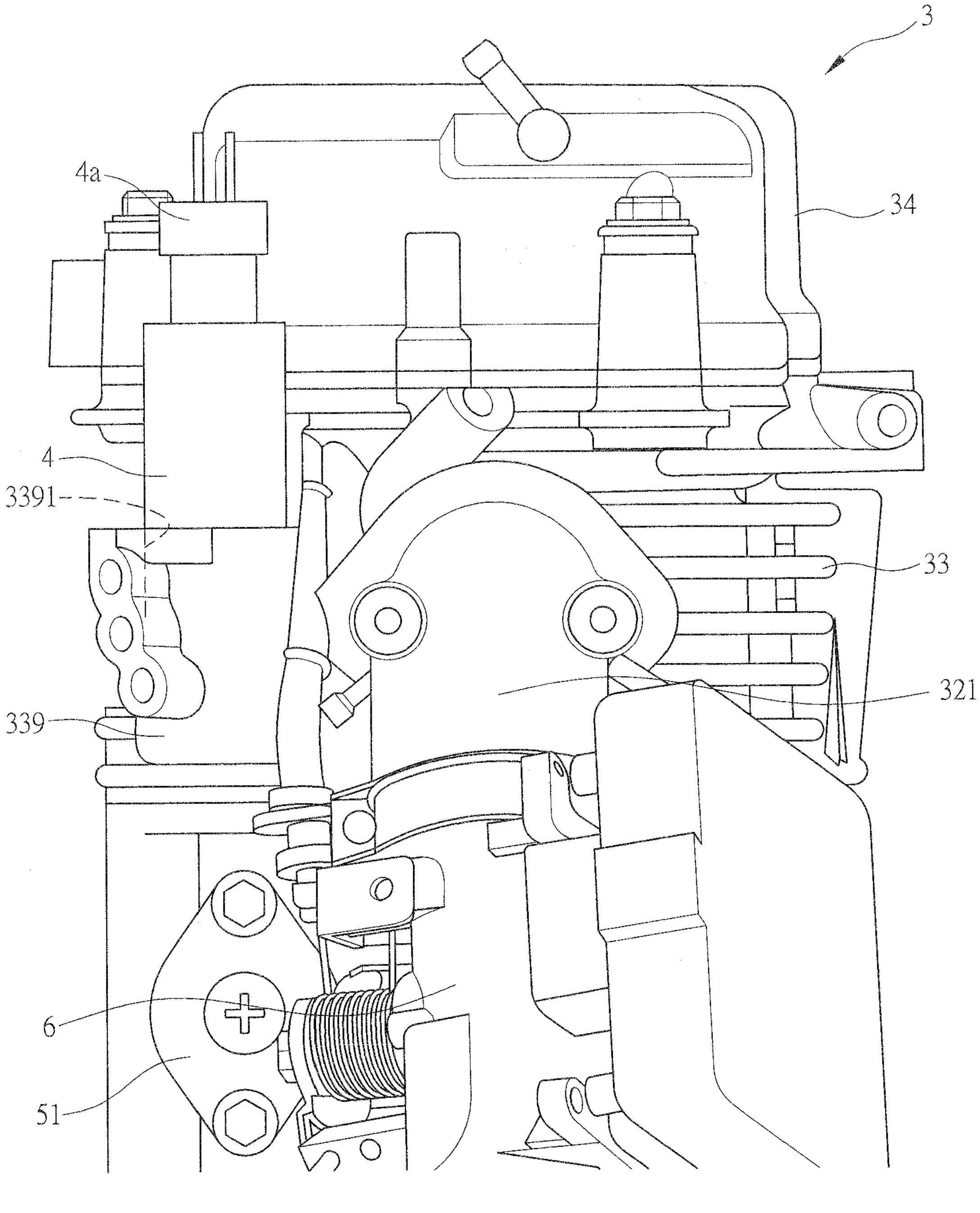

FIG.8

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 2558

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2009/025205 A1 (HONDA MOTOR CO LTD [JP]; KUMAGAI KAZUHIDE [JP]; NIIZATO TOMONORI [JP];) 26 February 2009 (2009-02-26) * abstract * * figures 2,3,9-18 * -----	1,2	INV. F01L1/26
A	EP 1 365 115 A2 (HONDA MOTOR CO LTD [JP]) 26 November 2003 (2003-11-26) * paragraph [0001] * * page 5, line 22 - line 23 * * paragraph [0038] * * paragraph [0051] * * figures * -----	1,6,8	
A	US 2002/059911 A1 (TAKAHASHI MASAYUKI [JP] ET AL) 23 May 2002 (2002-05-23) * paragraph [0002] * * paragraph [0054] * * paragraph [0056] - paragraph [0076] * * figures 8,10 * -----	1,2,8	
			TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 537 963 A (HASEBE TETSUYA [JP] ET AL) 23 July 1996 (1996-07-23) * figures 2,7 * * column 1, lines 8-20 * * column 11, lines 18-30 * -----	1,8,9	F01L
A	EP 0 639 694 A1 (HONDA MOTOR CO LTD [JP]) 22 February 1995 (1995-02-22) * column 1, line 1 - line 5 * * column 4, line 24 - column 7, line 41 * * column 11, line 19 - line 34 * * figures 2,6-8 * -----	1,6,8,9	

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	7 July 2011	Paquay, Jeannot

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 16 2558

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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